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TRIP REPORT: 1985 HARBOR PORPOISE AERIAL SURVEYS, SEPTEMBER 9 TO OCTOBER 15, 1985

by

Charles W. Oliver

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TRIP REPORT: 1985 HARBOR PORPOISE AERIAL SURVEYS,
SEPTEMBER 9 TO OCTOBER 15, 1985

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CONTENTS

	PAGE
INTRODUCTION.....	1
PLANNED ITINERARY.....	1
ITINERARY CHANGES.....	2
ACTUAL ITINERARY.....	3
PERSONNEL.....	3
PROCEDURES.....	4
RESULTS.....	6
DIFFERENCES FROM 1984 AERIAL SURVEY PROCEDURES.....	7
RECOMMENDATIONS.....	9
DISPOSITION OF DATA.....	11
APPENDIX 1. AERIAL SURVEY FORMS.....	28-29

LIST OF TABLES

TABLE		PAGE
1	Flight summary data for the 1985 harbor porpoise aerial surveys.....	12
2	Total sightings of marine mammals during flights 1-10 and 12-13 of the aerial surveys in September and October 1985. (Flight 1 off Oregon, all others off California). Data represent all sightings at sea, including those made off-effort and outside the strip being searched.....	13
3	Sightings of harbor porpoise and California sea lions, by latitude, for flights 1-10 and 12-13 conducted during September and October, 1985 along the California and Oregon coasts.....	13
4	Harbor porpoise sightings-per-area-surveyed for Beaufort sea state categories observed during flights 1-10 and 12-13 conducted during September and October, 1985 along the California and Oregon coasts. (A = area surveyed in square nautical miles; N = total number of harbor porpoise observed; S = sightings-per-area-surveyed).....	14
5	Harbor porpoise sightings-per-area-surveyed for the inside and outside swaths observed during flights 1-10 and 12-13 conducted during September and October, 1985 along the California and Oregon coasts. (A = area surveyed in square nautical miles; N = total number of harbor porpoise observed; S = sightings-per-area-surveyed).....	14
6	Harbor porpoise sightings-per-area-surveyed for categories of sea surface penetration, by left and right observer positions and inside and outside swaths. Data include flights 1-10 and 12-13 conducted during September and October, 1985 along the California and Oregon coasts. (A = area surveyed in square nautical miles; N = total number of harbor porpoise observed; S = sightings-per-area-surveyed.).....	15
7	Sightings of harbor porpoise and California sea lions, by time of day, for flights 1-10, 12-13 conducted during September and October, 1985 along the California and Oregon coasts.....	16

LIST OF TABLES (continued)

PAGE

8	Number of sightings of harbor porpoise and California sea lions, by number in groups, for flights 1-10, 12-13 conducted during September and October, 1985 along the California and Oregon coasts.....	16
9	The code table used by the Coastal Marine Mammal Project (NMFS) to identify, by numeric codes, species and stocks of cetaceans, pinnipeds, and other marine mammals.....	17
10	Marine mammal sightings 1985 harbor porpoise aerial surveys Point Conception, CA., to the Oregon/Washington border, September 11, 16-20, and October 14-15, 1985 flights 1-10, 12-13.....	18-25

LIST OF FIGURES

FIGURE

PAGE

- 1 Map showing the latitude range surveyed along the U.S. west coast during aerial surveys conducted between September 9 and October 15, 1985 for harbor porpoise. All flights were within 10 nautical miles of the coast..... 26
- 2 Frequency of sightings of California sea lions, by declination angle and swath, for flights 1-10 and 12-13 (N=107)..... 27
- 3 Frequency of sightings of harbor porpoise, by declination angle and swath, for flights 1-10 and 12-13 (N=107)..... 27

Trip Report: 1985 Harbor Porpoise Aerial Surveys,
September 9 to October 15, 1985

Charles W. Oliver

INTRODUCTION

This report presents the survey plan, procedures, and preliminary results from the second Southwest Fisheries Center aerial survey for harbor porpoise (*Phocoena phocoena*) conducted along the coast from Point Conception, California to Cape Flattery, Washington. The purpose of this survey was to collect data on the numbers and distribution of harbor porpoise in these coastal waters for estimation of the population size. Concurrent with this survey were shore based observations and a vessel survey utilizing the NOAA research vessel DAVID STARR JORDAN. The California Department of Fish and Game, the National Marine Mammal Laboratory, the Washington State Department of Game, and the Oregon Department of Fish and Game cooperated in this survey.

The objectives of this trip were as follows:

- 1) To replicate the 1984 aerial survey of the entire U.S. West coast at approximately .33 nautical miles from the coastline, thus providing a second year's coverage for the area not surveyed by the vessel.
- 2) To perform offshore and inshore transects in two areas of higher concentrations of harbor porpoise to compare the inshore/offshore distribution of harbor porpoise.
- 3) To survey the entire U.S. West coast at approximately 1.0 nautical miles offshore to provide comparable coverage by the aircraft and vessel. Analysis of these data may provide calibration of the two survey platforms and allow continued monitoring of the population from either.
- 4) To collect data on survey factors which might affect the sighting of marine mammals.
- 5) To record information on all marine mammal sightings within the surveyed waters.

PLANNED ITINERARY

September 9, 1985	Travel to Seattle, Washington
September 10, 1985	Survey Washington and Oregon coast at .33nm

September 11, 1985	Survey Washington and Oregon coast at .33nm
September 12, 1985	Survey offshore/inshore Cape Lookout to Tillamook Head
September 13, 1985	Travel to San Diego, California
September 16, 1985	Depart San Diego, California Survey Point Conception to Russian River at .33nm
September 17, 1985	Survey Russian River to California/Oregon border at .33nm Survey California/Oregon border to Cape Mendocino at 1.0nm Survey offshore/inshore at Fort Bragg, California during afternoon hours
September 18, 1985	Survey offshore/inshore at Fort Bragg, California during morning hours Survey Cape Mendocino to Russian River at 1.0nm
September 19, 1985	Survey Russian River to Monterey Bay at 1.0nm Survey Monterey Bay offshore/inshore
September 20, 1985	Survey Monterey Bay to Point Conception at 1.0nm Return to San Diego, California

ITINERARY CHANGES

We encountered very bad weather during the week of September 9-13 while attempting to survey in Oregon and Washington. Also, we were unable to obtain a twin-engine aircraft which I felt was needed to survey offshore. We therefore modified our plan to only survey the Oregon and Washington coasts at .33nm offshore as had been done in 1984, but were effectively prevented from accomplishing even the reduced plan due to the weather.

We had originally planned on conducting offshore/inshore transects at Fort Bragg, California and Monterey Bay, California. The former had been an area where higher numbers of harbor porpoise were sighted during 1984, and the latter an area of interest due to the incidental take. I was in touch with the research vessel while in Oregon, and we decided to only do offshore/inshore transects off Eureka, California since that was the only California area where numerous harbor porpoise were observed during the 1985 ship survey.

During the week of September 16-20, we were able to replicate the 1984 survey of California, but were unsuccessful at completing the other objectives to my satisfaction. We had winds and fog during the time we attempted to do offshore/inshore transects off Eureka, and were only able to survey part of the California coast at 1.0nm offshore.

Steve Jefferies (Washington Department of Game) conducted a survey of the Washington coast and part of the Oregon coast on October 4, 1985 under reasonable weather conditions.

We were able to survey the California coast at 1.0nm offshore under excellent weather conditions on October 14-15, 1985.

ACTUAL ITINERARY

September 9, 1985	Traveled to Seattle, Washington
September 10, 1985	Traveled to Newport, Oregon (bad weather)
September 11, 1985	Surveyed Oregon coast at .33nm (poor weather)
September 12, 1985	Traveled to Seattle, Washington (bad weather)
September 13, 1985	Traveled to San Diego, California
September 16, 1985	Departed San Diego, California Surveyed Point Conception to Russian River at .33nm
September 17, 1985	Surveyed parts of Russian River to Point Arena at .33nm (bad weather) Surveyed Fort Bragg to Point Mistake at .33nm (bad weather)
September 18, 1985	Surveyed Russian River to California/Oregon border at .33nm with a break south of Cape Mendocino Surveyed California/Oregon border to Eureka at 1.0nm
September 19, 1985	Surveyed Big Flat to Eureka, California at .33nm Surveyed offshore/inshore south of Punta Gorda (poor weather) Surveyed Big Flat to Eureka, California at 1.0nm Surveyed offshore/inshore Trinidad Head to Humboldt Bay, California
September 20, 1985	Surveyed Tomales Point to Point Sur, California at 1.0nm Returned to San Diego, California
October 4, 1985	Washington and Oregon surveyed at .33nm (non-Southwest Fisheries Center participation)
October 14, 1985	Departed San Diego, California Surveyed Point Conception to Russian River at 1.0nm (excellent weather)
October 15, 1985	Surveyed Russian River to California/Oregon border at 1.0nm (excellent weather) Returned to San Diego, California

PERSONNEL

Chuck Oliver	Southwest Fisheries Center	Chief Scientist/ Observer
Steve Jefferies	Washington State Dept. of Game	Observer/ Recorder

Robin Brown	Oregon Dept. of Fish and Game	Observer
Doyle Hanan	California Dept. of Fish and Game	Observer
Sandra Diamond	California Dept. of Fish and Game	Recorder
Jay Barlow	Southwest Fisheries Center	Recorder
Jim York	Sunrise Aviation, Newport, Oregon	Pilot
Larry Heitz	California Dept. of Fish and Game	Pilot
Rich Anthes	California Dept. of Fish and Game	Pilot

PROCEDURES

Surveys applied strip transect methodology to collect data using both a field form and a data recording form (Aerial Survey Effort and Sighting Forms for Strip Census - Appendix 1). Either a Cessna 172P or Cessna 337 Skymaster aircraft were flown with a pilot and data recorder seated in the front and two observers in the rear of the aircraft. Each flight was assigned a unique flight number, and consisted of a series of transects and legs within a transect. Flights were made at an altitude of 700 feet and an airspeed of approximately 90 knots. Each observer monitored two areas of approximately 1/8 statute mile each in width outbound of the transect path, with these areas being delineated by tape or trailing string markings mounted on the wing struts of the aircraft. These areas were referred to as "inside" and "outside", with all other area referred to as "extra". This latter area includes the non-observed area directly under the aircraft as well as the area outbound of the "outside" area. The "inside" area was delineated by declination angles of 35 to 67 degrees, and the "outside" area by declination angles of 36 to 23 degrees inclusive. The non-observed width of the area below the plane was approximately 600 feet at 700 foot altitude. During a flight, data were recorded about the degree of cloud cover, sea state, position of the sun and the time of a transect event (i.e., start transect, end transect, sighting). Positional data were obtained from the aircraft's LORAN C navigational unit. For each sighting, additional information was recorded about the number and species of animals sighted, apparent direction of travel, and the location of the sighting relative to the areas being observed (i.e., left inside, right outside, right extra). Hand held inclinometers were used to determine declination angles to each sighting, and to maintain desired distance from shore for flights that were parallel to the coastline.

Three survey patterns were used : 1) flights were made along the coastline at approximately .33 nautical miles from the breakerline, kelp bed or rocky shoreline; 2) flights were made along the coastline at approximately 1.0 nautical miles from the shoreline; and 3) flights were made along parallel transects spaced about two miles apart and extending from the coast seaward

approximately 10 nautical miles. During flights which paralleled the coast, we used a strut-marked declination angle of either 19 degrees (.33nm) or 6 degrees (1.0nm) to maintain our distance from shore. Inshore/offshore transects were flown at magnetic headings of 50 and 230 degrees in an attempt to minimize sun glare for the observers.

The field collection procedures required a data recorder to record sightings made by observers as well as information about environmental conditions and the aircraft. After takeoff the pilot would fly to a predetermined start point where sighting effort would begin. Any sightings made enroute were recorded as "off effort" or "off track". When the plane reached the start point of a transect the observers would begin searching their respective "inside" and "outside" areas while the recorder noted the start time and position for leg 1 of the transect. Additional data were recorded on conditions which might affect the observation of animals (i.e., vertical and horizontal sun positions, sea state, degree of water-surface penetration for each swath, the presence of haze, and the aircraft speed and altitude. If any of these conditions changed during a transect a new transect-leg was initiated. When the plane reached the end of the planned transect the observers ceased observing and the recorder noted the end time and position. The pilot then proceeded to the next transect start point. Again any sightings which occurred between transects were recorded as "off effort".

When a sighting occurred "on effort" the observer making the sighting would call out, and the recorder immediately indicated the sighting number and recorded the time and position. Observers dictated into hand-held tape recorders pertinent data about a sighting including the number seen, the area or areas occupied, direction of travel of the animals in relation to the aircraft heading, the angle of declination to the sighting and the species observed. If a closer look was required, observers directed the pilot to circle back to the sighting and concentrated their efforts on resighting the animals, while the recorder noted the time and position at the moment the plane diverted from the transect. The plane then circled to observe the sighting as necessary. Any additional sightings made while circling were recorded as "off effort". The pilot then attempted to resume the transect at the point of diversion, the observers resumed searching, and the recorder noted the time and position at which effort for the transect-leg resumed. Declination angle, direction of travel, sun positions, and area occupied were not collected for "off effort" sightings.

If either the pilot or recorder made a sighting which was missed by the observers, the data were recorded as "off effort" even if the sighting was made in the "inside" or "outside" swaths.

The data for each sighting were transferred to the recorder either between sightings, if time permitted, or at the end of the flight by reviewing the observer's tapes and recorder's notes.

Transferring data between sightings was the preferred method as this reduced the chance of losing data.

At the completion of a flight, data were transcribed from the field form to a second data coding form (Appendix 1). The latter form is a modification of one developed for aerial surveys using line transect methodology. Transcription involved the use of the 1983 Aerial Survey Effort and Sighting Record Coding Format for Strip Census, the Beaufort Scale Codes for sea state conditions, and a list of Marine Mammal Codes for each species.

Once coded the forms were sent to a commercial keypunch service for keypunching and verification of the keypunched data. The data were subsequently entered into a computer file. A series of computer programs were used to plot effort and sightings for each flight. Once these plots had been checked for errors, another series of computer programs were used to summarize the data.

RESULTS

A total of 13 flights were conducted between September 11 and October 15, 1985 for California, Oregon, and Washington. A summary of the flight data for these are presented in Table 1. Flights 2, 4, and 6 (combined) represent a replication of the 1984 survey for the California coast, from Point Conception to the California/Oregon border, at .33nm from the coastline. These flights were conducted as the RV/DAVID STARR JORDAN was completing its survey and were flown during reasonable weather conditions. Flights 12 and 13 represent the California coastal survey at 1.0nm offshore. This survey was conducted four weeks after the JORDAN survey under excellent weather conditions. Flights 1 and 11 were attempts at replicating the 1984 survey at covered Oregon only under poor weather, and flight 11 surveyed all of the Washington coast and approximately 2/3 of the Oregon coast under reasonable conditions. The data for flight 11 has not yet been received from the participants. Flights 7 and 9 were offshore/inshore transect surveys in California, and flights 5, 8, and 10 were surveys at 1.0nm from the California coastline for parts of the coast. Flight 3 data covered only small parts of the coast of California at .33nm, but was repeated on flight 4 due to the bad weather encountered during flight 3.

Table 2 presents the number of sightings and total number of animals observed for all flights (except flight 11), and all categories of marine mammals observed. Sightings of harbor porpoise and California sea lions, the two most commonly sighted species, are presented by latitude of observation in Table 3. The number of harbor porpoise sighted, area surveyed, and sightings-per-area-surveyed are shown stratified by Beaufort in Table 4, and by inside or outside swaths in Table 5. The number of harbor porpoise sighted, and area surveyed, are stratified by left and right observer positions and sea surface penetration categories

in Table 6. Sightings of harbor porpoise and California sea lions, by time of day, are shown in Table 7. Sightings of these two species, by group size, are presented in Table 8. A list of Marine Mammal Species Codes used for these surveys is shown in Table 9, and Table 10 presents individual sighting data for all sightings of marine mammals made for flights 1-10, and 12-13.

Figure 1 is a map showing the areas surveyed during all flights. Figures 2 and 3 present the frequency of sightings, by declination angle, for California sea lions and harbor porpoise respectively. Appendix 1 contains the field and data coding forms used during these surveys.

From past aerial surveys, sighting conditions and observer expertise have been shown to affect the number of sightings. Sun angles exhibit an effect on the degree of water penetration and apparent color of the sea. Inshore turbidity may also affect water color and can increase contrast. These factors may interact with the size, shape, color, and behavior of various marine mammals to reduce or enhance their chances of being sighted. Wind and swell create additional activity at the sea surface which compete with marine mammals for the observer's attention. An observer's eyesight, past experience with sighting objects from the air, and ability to quickly identify marine mammals may also affect the number of sightings. These preliminary data show that more harbor porpoise were sighted at lower Beauforts than higher ones, more by the right observer than the left observer (constant observers and positions), more when sea surface penetration was excellent than when poor, and that more animals were sighted within the inside swath than in the outside swath (Tables 4-6). Harbor porpoise were more often seen at higher latitudes in California (Table 2), and early in the morning (Table 7). California sea lions, however, were seen more often at lower latitudes and during midday. The assumptions of strip transect require that all animals within the surveyed strips be seen. The data in Figures 2 and 3 appear to indicate that animals were missed in the "outside" swath since the frequency of sightings is less for approximately equal areas. The effective swath width may be determined from these data however. These data need to be further examined to adjust for the amount of effort (e.g. area surveyed) in the combinations of these variables.

DIFFERENCES FROM 1984 AERIAL SURVEY PROCEDURES

The available information indicates that the 1984 survey maintained a distance of .33nm from the breakerline only. During flight 2, I continued this plan from Point Conception to Pillar Point at which time we subsequently maintained our distance from the coast based on the breakerline, or the outer edge of either the kelp bed or rocky coast. From Morro Bay to Pillar Point I had observed that the kelp beds often infringed on the outside and inside swaths and decided to move further offshore to survey open water. This procedural change may account for the reduced number of sea otter sightings made during 1985 when compared with the 1984 results.

The 1984 survey procedures required that all harbor porpoise sightings be circled for additional observation and counts. Our procedures were the same except for sightings of harbor porpoise where the sighting conditions were excellent and the observer felt he had obtained a good look at the sighting. For these sightings we did not always circle the sighting.

The computer format for archiving the 1985 data differs slightly from the 1984 data format, and additional codes were added for new observers, direction of travel, and area. The format differences are as follows:

VARIABLE	1984	1985
AREA	NOT CODED	COLUMN 1
FLIGHT NUMBER	COLUMNS 4-5	COLUMNS 2-3
TRANSECT NUMBER	NOT CODED	COLUMNS 4-5
SWATH WIDTH CODE	NOT CODED	COLUMN 35
COUNTS ? CODE	COLUMN 66	COLUMN 62
DECLINATION ANGLE TO SIGHTING	COLUMN 62-63	COLUMNS 70-71
DECLINATION ANGLE TO SHORELINE	COLUMNS 64-65	NOT CODED
DIRECTION OF TRAVEL	NOT RECORDED	COLUMNS 68-69

Harbor porpoise were generally sighted either singularly or in small groups (Table 8). Data for both 1984 and 1985 surveys are coded to indicate only the maximum number of animals totaled for the sighting (in the swath or swaths observed). During the 1985 survey, we noted the initial number of harbor porpoise sighted, the number of groups, and the individual group totals counted if additional animals were seen for a sighting which was circled. These data are on the original field forms and not archived in the computer format.

The positional data for the 1984 survey was obtained from either an onboard LORAN C navigational unit or approximated from maps as the survey progressed. All positional data was obtained from the LORAN C unit for the 1985 survey. During flight 12, we obtained erroneous position data between 1203-1320 hours. These positions were apparently the result of a consistent error. I corrected these data by adding 6 minutes to the longitude position and subtracting 15 minutes from the latitude position for all records with times of 1203.7-1312.0. Records with times of 1317.4-1320.8 were corrected by adding 3 minutes to the longitude position and subtracting 15 minutes from the latitude position. These corrections exist only in the computer databases and were not made to either the original field forms or the data coding forms.

During observational effort, either observer could encounter conditions where he felt he could not survey while the other observer continued effort. For the 1985 survey these occurrences are indicated in the data by the appropriate observer variable being non-blank and the corresponding sea surface penetration

variable being blank. It is unclear if this situation occurred during the 1984 survey, or if it did, how the data reflects the occurrence.

Sightings by the recorder or pilot were opportunistic as they were unable to perform continuous survey effort. However, the assumptions of strip transect methodology require that all animals are seen within the swaths surveyed. During the 1985 survey, sightings made by either the recorder or pilot were recorded as not to be included (variable COUNTS =2) for purposes of determining sightings-per-area-surveyed. However, we collected these data to address the fact that some sightings may be missed by the observers within the swaths surveyed. Six sightings were noted during flights 4, 12, and 13. These sightings were as follows:

FLIGHT	SIGHTING	WHOM	COMMENTS
4	3	Pilot	3 unidentified dolphins-inside swath
12	11	Recorder	3 sea lions-no swath indicated
12	32	Recorder	1 sea lion within the inside swath
13	10	Pilot	6 harbor porpoise-extra area
13	18	Pilot	4 harbor porpoise-extra area
13	73	Recorder	4-5 harbor porpoise-inside swath

The extra area sightings are of no concern since this area is not continuously surveyed by the observers. The three sightings by either the recorder or pilot for the inside swath do indicate that some animals are missed by the observers. However, the incidence of this type of occurrence is believed to be small.

RECOMMENDATIONS

From past aerial observation experience and these surveys, I recommend that harbor porpoise aerial surveys only be conducted when weather conditions are predicted to be clear sky, little haze, and winds of Beaufort 3 or less. Harbor porpoise are small, dark to light brown in color, were usually sighted either singularly or in groups of less than 10, and did not exhibit splashing or other active behaviors. These attributes require that observational conditions be excellent to good in order to be confident that the assumptions of strip transect sampling are met.

I recommend that future surveys reserve a greater number of days during which the actual flights will be made only during good weather conditions. Scheduling a block of time for obtaining an aircraft has been done far in advance of the survey dates. The current survey design required a full three days of flights for the Oregon/Washington area and five days for California. In addition, scheduling of personnel to conduct the flights was done

in advance due to other conflicting projects. This situation resulted in some of the planned work not being accomplished due to poor or bad weather conditions, and subsequent problems with personnel obligations. The survey design could be modified to eliminate some of the planned work (e.g.. no offshore/inshore transects), but additional standby days should still be scheduled to accommodate poor weather. This could increase the cost of contracting aircraft time, but the additional cost for standby days should be less than for actual flying time.

I recommend that flights which parallel the coast be conducted generally northbound. The survey design requirement to maintain a distance from shore of either .33nm or 1.0nm resulted in frequent changes in the sighting conditions due to changing sun positions in relation to the aircraft. During the generally northbound flights, we did not find sun glare to be much of a problem except at headlands or large bays. Flights which were generally southbound did encounter a problem with one or the other observer being unable to survey due to sun glare. This difference was due to the relative position of the aircraft and sun. Flying with the sun behind was better than flying into the sun.

I recommend that offshore/inshore transects be flown at magnetic headings of 210 degrees and 30 degrees respectively to reduce the effect of sun glare. These headings were chosen after consideration of the time of year and time of day flights were conducted. We flew the offshore/inshore transect flights at magnetic headings of 230 and 50 degrees respectively. These headings deviated from what I believe are better headings of 210 and 30 degrees due to strong northwest winds. The crab angle used to compensate for the wind resulted in less desirable observation conditions, which would not be a factor if future flights were conducted under light wind conditions at the suggested headings.

While I believe the incidence of missed sightings by observers within the surveyed swaths is small, this could be tested by utilizing a larger aircraft. Two additional observers could simultaneously monitor the same swaths and the results compared with the regular observers.

The appropriate swath widths, and angles to delineate them, should be studied to determine if these data meet the assumptions of strip transect. The two swaths currently used are of equal width, but are delineated by unequal angles. Assuming an observer scans the water at a steady pace, then more time would be spent looking at the "inside" swath due to the larger angle. Also, as sighting conditions worsen, the observers may require a greater amount of time to effectively scan the water as the aircraft moves along the trackline, and compensate for the worsening conditions by reducing the actual width of the swaths surveyed.

I recommend that future surveys reserve a greater number of days during which the actual flights will be made only during good weather conditions. Scheduling a block of time for

obtaining an aircraft has been done far in advance of the survey dates (generally December or January). The current survey design required a full three days of flights for the Oregon/Washington area and five days for California. In addition, scheduling of personnel to conduct the flights was done in advance due to other conflicting projects. This situation resulted in some of the planned work not being accomplished due to poor or bad weather conditions, and subsequent problems with personnel obligations. The survey design could be modified to eliminate some of the planned work (e.g. no offshore/inshore transects), but additional standby days should still be scheduled to accommodate poor weather. This could increase the cost of contracting aircraft time, but the additional cost for standby days should be less than actual flying time.

DISPOSITION OF DATA

The original field data and computer data bases are archived at the SWFC and retained by the Chief Scientist for further analyses.

Table 1. Flight summary data for the 1985 harbor porpoise aerial surveys.

FLIGHT NUMBER	DATE (yy/mo/day)	TIME OF DAY (24 hour)	OBSERVERS LEFT RIGHT	LATITUDE RANGE (Degrees)	DISTANCE FROM COAST (nm)	ON-EFFORT AREA SURVEYED (nm)	ON-EFFORT NUMBER OF HARBOR PORPOISE SIGHTED	OFF-EFFORT NUMBER OF HARBOR PORPOISE SIGHTED	COMMENTS
*1	85/09/11	1058-1501	Olliver	Jefferies	41.7-46.1	.33	122.1	0	North bound onshore: Crescent City to Columbia River
*2	85/09/16	1014-1602	Hanan	Olliver	34.4-38.3	.33	137.0	18	Northbound onshore: Point Conception to Russian River
3	85/09/17	1108-1135 1513-1541	Hanan	Olliver	38.2-39.7	.33	32.0	6	Northbound onshore: Bodega Head to Point Arena: Fort Bragg to Point Mistake
*4	85/09/18	1213-1508	Hanan	Olliver	38.5-42.1	.33	93.6	16	Northbound onshore: Bodega Head to Big Flat: Cape Mendocino to California/Oregon Border
5	85/09/18	1509-1559	Hanan	Olliver	40.7-42.1	1.0	20.6	0	Southbound offshore: California/Oregon Border to Humboldt Bay
*6	85/09/19	0953-1032	Hanan	Olliver	40.1-40.8	.33	19.8	38	Northbound onshore: Big Flat to Humboldt Bay
7	85/09/19	1048-1154	Hanan	Olliver	40.0-40.3	out to 10	25.8	3	Offshore-Onshore Transects at Punta Gorda
8	85/09/19	1155-1222	Hanan	Olliver	40.1-40.7	1.0	17.4	14	Northbound offshore: Big Flat to Humboldt Bay
9	85/09/19	1402-1525 1604-1609	Hanan	Olliver	39.4-41.2	out to 10	52.9	8	Offshore-onshore transects Trinidad Head to Humboldt Bay plus 9 nm southbound onshore
10	85/09/20	1152-1352	Hanan	Olliver	36.2-38.2	1.0	67.6	50	Southbound offshore: Tomales Point to Point Sur
*11	85/10/04			--	---	--	--	--	Washington and Oregon
**12	85/10/14	1045-1321 1438-1621	Hanan	Olliver	34.4-38.5	1.0	128.6	42	Northbound offshore
**13	85/10/15	0840-1206	Hanan	Olliver	38.3-42.1	1.0	105.8	195	Northbound offshore
Totals							390	148	

*These flights replicated 1984 survey northbound from Point Conception to the Canada/Washington border approximately .33 nm from the coastline.

**These flights covered the California coast northbound from Point Conception to the California/Oregon border approximately 1.0 nm from the coastline.

Table 2. Total sightings of marine mammals during flights 1-10 and 12-13 of the aerial surveys in September and October 1985. (Flight 1 off Oregon, all others off California). Data represent all sightings at sea, including those made off-effort and outside the strip being searched.

Marine Mammal	Number of Sightings	Number Sighted
Harbor porpoise	146	538
Gray whales	4	4
Unidentified dolphin or porpoise	1	3
Southern sea otter	2	2
California sea lion	122	510
Northern elephant seal	2	2
Harbor seal	7	37
Steller sea lion	2	2
Unidentified pinniped	19	21
Unidentified whale	1	2

Table 3. Sightings of harbor porpoise and California sea lions, by latitude, for flights 1-10 and 12-13 conducted during September and October, 1985 along the California and Oregon coasts.

LATITUDE IN DEGREES	Harbor Porpoise		California Sea Lion	
	NUMBER OF SIGHTINGS	NUMBER SIGHTED	NUMBER OF SIGHTINGS	NUMBER SIGHTED
46	0	0	0	0
45	0	0	0	0
44	0	0	1	1
43	0	0	1	1
42	1	1	0	0
41	14	30	9	30
40	71	207	5	7
39	29	158	2	4
38	9	33	11	89
37	6	54	19	56
36	11	31	44	209
35	3	9	29	112
34	2	15	1	1
TOTALS	146	538	122	510

Table 4. Harbor porpoise sightings-per-area-surveyed for Beaufort sea state categories observed during flights 1-10 and 12-13 conducted during September and October, 1985 along the California and Oregon coasts. (A = area surveyed in square nautical miles; N = total number of harbor porpoise observed; S = sightings-per-area-surveyed).

Sea State	A	N	S
1	139.3	200	1.44
2	341.5	156	.46
3	213.7	29	.14
4	115.8	2	.02
5	11.3	3	.27
Total	821.6	390	.47

Table 5. Harbor porpoise sightings-per-area-surveyed for the inside and outside swaths observed during flights 1-10 and 12-13 conducted during September and October, 1985 along the California and Oregon coasts. (A = area surveyed in square nautical miles; N = total number of harbor porpoise observed; S = sightings-per-area-surveyed).

Swath	A	N	S
Inside	404.8	243	.60
Outside	416.8	147	.35
Both	821.6	390	.47

Table 6. Harbor porpoise sightings-per-area-surveyed for categories of sea surface penetration, by left and right observer positions and inside and outside swaths. Data include flights 1-10 and 12-13 conducted during September and October, 1985 along the California and Oregon Coasts. (A = area surveyed in square nautical miles; N = total number of harbor porpoise observed; S = sightings-per-area-surveyed.)

Sea surface ¹ Penetration Category	LEFT OBSERVER POSITION						RIGHT OBSERVER POSITION											
	INSIDE SWATH			OUTSIDE SWATH			INSIDE & OUTSIDE SWATHS			INSIDE SWATH			OUTSIDE SWATH			INSIDE & OUTSIDE SWATHS		
	A	N	S	A	N	S	A	N	S	A	N	S	A	N	S	A	N	S
Excellent = 1	36.8	55	1.50	4.3	0	0.	41.1	55	1.34	64.4	58	.90	29.7	53	1.78	94.1	111	1.18
Good = 2	111.4	23	.21	115.2	39	.34	226.6	62	.27	83.6	98	1.17	68.4	12	.18	152.0	110	.72
Poor = 3	60.2	3	.05	94.9	0	0.	155.1	3	.02	48.4	6	.12	104.3	43	.41	152.7	49	.32
No Data: Observer Off Effort	4.0	--	---	4.2	--	---	8.2	--	---	15.9	--	---	16.1	--	---	32.0	---	---
Total for 1 + 2 + 3	208.4	81	.39	214.4	39	.18	422.8	120	.28	196.4	162	.82	202.4	108	.53	398.8	270	.68

¹ Excellent meant no glare on observed swath surfaces and good water contrast.
Good meant no glare on observed swath surfaces and little water contrast.
Poor meant glare on observed swath surfaces and little or no water contrast.

Table 7. Sightings of harbor porpoise and California sea lions, by time of day, for flights 1-10, 12-13 conducted during September and October, 1985 along the California and Oregon coasts.

Time of Day (24 hour)	Harbor Porpoise		California sea lion	
	Number of Sightings	Number Sighted	Number of Sightings	Number Sighted
0800 - 0859	0	0	1	3
0900 - 0959	27	163	8	10
1000 - 1059	55	176	2	2
1100 - 1159	23	70	41	229
1200 - 1259	13	51	43	175
1300 - 1359	9	38	12	69
1400 - 1459	7	16	4	4
1500 - 1559	10	21	11	18
1600 - 1659	2	3	0	0
Totals	146	538	122	510

Table 8. Number of sightings of harbor porpoise and California sea lions, by number in group, for flights 1-10, 12-13 conducted during September and October, 1985 along the California and Oregon Coasts.

Number in Group	Harbor Porpoise		California sea lion	
	Number of Sightings	Number Sighted	Number of Sightings	Number Sighted
1- 5	126	282	103	158
6-10	11	79	8	51
11-15	5	61	2	30
16-20	1	18	4	73
21-25	2	48	0	0
26-30	0	0	3	81
31-35	0	0	0	0
36-40	0	0	0	0
41-45	0	0	1	45
46-50	1	50	0	0
>50	0	0	1	72
Total	146	538	122	510

Table 7. The code table used by the Coastal Marine Mammal Project (NMFS) to identify, by numeric codes, species and stocks of cetaceans, pinnipeds, and other marine mammals.

Species code	Short Name	Code Table 15 Marine Mammal Codes	Scientific Name
5	Unfd. delph	(1981-)	Delphinus delphis
13	Streaker	(1981-)	S. coeruleoalba
18	Tursiops	(1981-)	Tursiops truncatus
21	Grampus	(1981-)	Grampus griseus
22	Lagenorhynchus	(1981-)	Lagenorhynchus obliquidens
25		(1981-)	L. obscurus
27	Lissodelphis	(1981-)	Lissodelphis borealis
31	Peponocephala	(1981-)	Peponocephala electra
32	Feresa	(1981-)	Feresa attenuata
33	Pseudorca	(1981-)	Pseudorca crassidens
34	Globicephala	(1981-)	Globicephala sp.
35	Globicephala	(1981-)	Globicephala melana
36	Globicephala	(1981-)	Globicephala macrorhynchus
37		(1981-)	Orcinus orca
40		(1981-)	Phocoena phocaena
41		(1981-)	P. sinus
44		(1981-)	Phocoenoides dalli
46		(1981-)	Physeter catodon
47		(1981-)	Kogia brevicoaps
48		(1981-)	Kogia sinus
49		(1981-)	Ziphiid
51	Mesoplodont	(1981-)	Mesoplodon sp.
61		(1981-)	Ziphius cavirostris
62		(1981-)	Barardius arnoux
64		(1981-)	Iasmacetus shepherdi
69		(1981-)	Eschrichtius robustus
70	Unfd. rorqual	(1981-)	Balaenoptera sp.
71		(1981-)	B. acutorostrata, B. bonaerensis
72		(1981-)	B. edeni
73		(1981-)	B. borealis
74		(1981-)	B. physalus
75		(1981-)	B. musculus
76	Humpback whale	(1981-)	Megaptera novaeangliae
77	Unfd. porpoise	(1981-)	
78	Unfd. Sm. Whale	(1981-)	Enhydra lutris nereis
79	Unfd. Lrg. Whale	(1981-)	Zalophus californianus
80	S. Sea Otter	(1981-)	Mirovanga angustirostris
91	Sea lion	(1981-)	Phoca vitulina
92	Elephant seal	(1981-)	Callorhinus ursinus
93	Harbor seal	(1981-)	Eumetopias jubatus
94	N. fur seal	(1981-)	Arctocephalus townsendi
95	Steller sea lion	(1981-)	
96	S. fur seal	(1981-)	
97		(1981-)	
98		(1981-)	
99		(1981-)	

Marine Mammal Sightings
1985 Harbor Porpoise Aerial Surveys
Point Conception, CA. to the Oregon/Washington Border
September 11, 16-20, and October 14-15, 1985
Flights 1-10, 12-13

Marine Mammal Species Code	Estimated Number of Animals	Declination Angle to Sighting (Degrees)	Flight Transect Leg	Sighting Number	Date	Local Time (Decimal) (Minute)	Position (Decimal Minute)	On=1 Off=2 Effort	Left=1 Right=2 Side	Inside=1 Outside=2 Extra=3 Swath	Beaufort Sea State
40	4	42	2	1 21	850916	12 447	36 502 N 121 488 W	1	2	1	2
40	5		2	1 21	850916	12 447	36 502 N 121 488 W	1	1	1	2
40	1	32	2	2 1	850916	14 283	36 550 N 121 517 W	1	2	2	2
40	5	34	2	2 7	850916	15 21	37 188 N 122 250 W	1	2	2	2
40	3	33	2	2 10	850916	15 187	37 388 N 122 304 W	1	2	2	2
40	6	38	3	1 4	850917	11 202	38 285 N 123 112 W	1	2	1	2
40	3	42	4	2 2	850918	13 537	40 323 N 124 232 W	1	2	1	3
40	2	31	4	2 2	850918	13 541	40 329 N 124 228 W	1	2	2	3
40	2	42	4	2 2	850918	13 541	40 340 N 124 223 W	1	1	1	3
40	2	42	4	2 4	850918	14 6	40 416 N 124 180 W	1	2	1	4
40	2	48	4	2 4	850918	14 279	41 127 N 124 79 W	1	1	1	4
40	4	42	4	2 10	850918	14 572	41 500 N 124 143 W	1	1	2	5
40	1	33	4	2 15	850918	15 19	41 572 N 124 131 W	1	2	2	5
40	2	34	4	2 15	850918	9 535	40 144 N 124 239 W	1	2	2	2
40	6		6		850919	9 546	40 135 N 124 214 W	2	2	2	2
40	4		6		850919	9 550	40 137 N 124 215 W	2	2	2	2
40	2		6		850919	9 550	40 136 N 124 223 W	2	2	2	2
40	1		6		850919	9 557	40 128 N 124 220 W	2	2	2	2
40	2		6		850919	9 582	40 105 N 124 184 W	2	2	2	2
40	2		6		850919	9 583	40 105 N 124 181 W	2	2	2	2
40	5		6		850919	9 589	40 113 N 124 184 W	2	2	2	2
40	8		6		850919	9 594	40 106 N 124 186 W	2	2	2	2
40	7		6		850919	10 50	40 110 N 124 179 W	1	1	1	2
40	1	45	6	1	850919	10 54	40 112 N 124 186 W	1	1	1	2
40	1	50	6	1	850919	10 57	40 116 N 124 190 W	1	1	1	2
40	2	50	6	1	850919	10 63	40 121 N 124 199 W	1	2	1	2
40	4	56	6	1	850919	10 64	40 122 N 124 200 W	1	2	1	2
40	3	47	6	1	850919	10 67	40 124 N 124 204 W	1	2	1	2
40	4	44	6	1	850919	10 73	40 131 N 124 214 W	1	1	1	2
40	1	60	6	1	850919	10 74	40 132 N 124 215 W	1	1	2	2
40	1	35	6	1	850919	10 77	40 134 N 124 216 W	1	2	1	2
40	3	44	6	1	850919	10 79	40 134 N 124 217 W	1	2	2	2
40	6	29	6	1	850919	10 83	40 141 N 124 222 W	1	1	1	2
40	2	45	6	1	850919	10 88	40 147 N 124 232 W	1	2	2	2
40	6	29	6	1	850919	10 88	40 147 N 124 232 W	1	1	1	2
40	2	50	6	1	850919	10 146	40 230 N 124 248 W	1	1	1	3
40	2	50	6	1	850919	10 151	40 237 N 124 250 W	1	1	1	3
40	1	50	6	1	850919	10 163	40 251 N 124 267 W	1	1	2	3
40	1	27	6	1	850919	10 203	40 304 N 124 258 W	1	1	3	3
40	1	20	6	1	850919	10 203	40 304 N 124 258 W	1	1	2	3
40	3	54	6	1	850919	10 251	40 375 N 124 225 W	1	2	1	3
40	7		7	3	850919	11 74	40 124 N 124 219 W	1	1	1	3
40	2	40	7	7	850919	11 395	40 88 N 124 152 W	1	1	1	2
40	1	40	8	1	850919	11 577	40 102 N 124 187 W	1	2	1	2
40	4	39	8	1	850919	12 122	40 275 N 124 284 W	1	2	1	3
40	3	55	8	1	850919	12 162	40 330 N 124 258 W	1	2	2	2
40	1	47	8	1	850919	12 164	40 331 N 124 257 W	1	2	1	2
40	1	39	8	1	850919	12 164	40 331 N 124 257 W	1	2	1	2
40	1	45	8	1	850919	12 173	40 346 N 124 248 W	1	1	1	2

Table 10.

Marine Mammal Sightings
1985 Harbor Porpoise Aerial Surveys
Point Conception, CA. to the Oregon/Washington Border
September 11, 16-20, and October 14-15, 1985
Flights 1-10, 12-13

Marine Mammal Species Code	Estimated Number of Animals	Declination Angle to Sighting (Degrees)	Flight Transect Leg	Sighting Number	Date	Local Time (Decimal) (Minute)	Position (Decimal Minute)	On=1 Off=2 Effort	Left=1 Right=2 Side	Inside=1 Outside=2 Extra=3 Swath	Beaufort Sea State
40	2	27	8	1	6	850919	12 173	40 348 N 124 247 W	1	2	2
40	2	47	8	1	6	850919	12 181	40 355 N 124 244 W	1	1	2
40	1	53	9	10	1	850919	15 71	40 461 N 124 194 W	1	1	2
40	1	44	9	10	1	850919	15 72	40 462 N 124 191 W	1	1	2
40	1	50	9	10	1	850919	15 75	40 463 N 124 190 W	1	1	2
40	2	50	9	10	1	850919	15 83	40 471 N 124 176 W	1	1	2
40	1	38	9	10	1	850919	15 85	40 472 N 124 174 W	1	1	2
40	2	36	9	12	2	850919	15 239	40 412 N 124 208 W	1	1	2
40	15	32	10	1	18	850920	12 336	37 367 N 122 310 W	1	2	2
40	12	36	10	1	21	850920	12 502	37 198 N 122 255 W	1	1	1
40	1	45	10	1	21	850920	12 502	37 198 N 122 255 W	1	1	1
40	18	35	10	1	26	850920	13 23	37 51 N 122 216 W	1	2	1
40	2	32	10	1	38	850920	13 228	36 524 N 121 512 W	1	1	1
40	2	50	10	1	38	850920	13 234	36 515 N 121 506 W	1	1	3
40	12	4	12	1	4	851014	10 577	34 422 N 120 369 W	1	1	3
40	3	47	12	1	8	851014	11 132	34 591 N 120 396 W	1	1	2
40	4	40	12	1	8	851014	11 176	35 3 N 120 398 W	1	1	2
40	2	40	12	1	14	851014	11 568	35 368 N 121 97 W	1	1	2
40	3	45	12	1	17	851014	12 92	35 480 N 121 237 W	1	1	1
40	4	41	12	1	30	851014	13 100	36 398 N 121 522 W	1	1	1
40	1	44	12	1	31	851014	13 174	36 467 N 121 490 W	1	2	3
40	4	44	12	1	31	851014	13 185	36 467 N 121 490 W	2	1	3
40	3	47	12	2	1	851014	14 413	36 557 N 121 528 W	1	1	3
40	4	38	12	2	1	851014	14 413	36 557 N 121 528 W	1	1	3
40	1	39	12	2	1	851014	14 425	36 557 N 121 528 W	1	1	2
40	3	45	12	2	23	851014	15 573	38 24 N 123 5 W	2	1	2
40	2	60	12	2	25	851014	16 40	38 113 N 122 588 W	1	1	1
40	1	34	12	2	26	851014	16 91	38 160 N 122 599 W	1	1	1
40	10	64	13	1	2	851015	9 47	38 485 N 123 457 W	1	1	1
40	2	54	13	1	3	851015	9 97	38 519 N 123 454 W	1	2	1
40	6	49	13	1	4	851015	9 146	38 526 N 123 463 W	1	1	1
40	2	46	13	1	4	851015	9 148	38 528 N 123 464 W	2	1	1
40	3	50	13	1	5	851015	9 192	38 572 N 123 489 W	2	2	1
40	2	44	13	1	5	851015	9 230	39 6 N 123 463 W	1	1	1
40	3	44	13	1	5	851015	9 258	39 13 N 123 464 W	1	1	1
40	2	38	13	1	5	851015	9 258	39 13 N 123 464 W	1	1	1
40	2	20	13	1	6	851015	9 293	39 49 N 123 466 W	1	1	1
40	4	44	13	1	8	851015	9 361	39 118 N 123 502 W	1	3	1
40	1	44	13	1	9	851015	9 504	39 334 N 123 497 W	1	1	1
40	2	40	13	1	9	851015	9 505	39 334 N 123 497 W	1	1	1
40	25	55	13	1	9	851015	9 505	39 334 N 123 497 W	1	1	1
40	50		13	1	9	851015	9 510	39 334 N 123 497 W	2	2	1
40	2		13	1	9	851015	9 585	39 380 N 123 503 W	1	3	1

Table 10.

Marine Mammal Sightings
1985 Harbor Porpoise Aerial Surveys
Point Conception, CA. to the Oregon/Washington Border
September 11, 16-20, and October 14-15, 1985
Flights 1-10, 12-13

Marine Mammal Species Code	Estimated Number of Animals	Declination Angle to Sighting (Degrees)	Flight Transect Leg	Sighting Number	Date	Local Time (Decimal) (Minute)	Position (Decimal Minute)	On=1 Off=2 Effort	Left=1 Right=2 Side	Inside=1 Outside=2 Extra=3 Swath	Beaufort Sea State
40	2	45	13	1 10	851015	10 5	39 413 N 123 509 W	1	1	1	1
40	10	25	13	1 10	851015	10 15	39 426 N 123 519 W	1	1	2	1
40	1		13	1 10	851015	10 20	39 425 N 123 517 W	2			1
40	2	51	13	1 10	851015	10 35	39 442 N 123 532 W	1	1	1	1
40	3	52	13	1 10	851015	10 37	39 442 N 123 532 W	1	2	1	1
40	3	55	13	1 10	851015	10 38	39 445 N 123 539 W	1	1	1	1
40	1	47	13	1 10	851015	10 64	39 457 N 123 535 W	1	1	1	1
40	1	49	13	1 10	851015	10 70	39 465 N 123 535 W	1	1	1	1
40	2	56	13	1 10	851015	10 71	39 469 N 123 536 W	1	2	1	1
40	3	35	13	1 10	851015	10 75	39 474 N 123 535 W	1	2	1	1
40	1	37	13	1 11	851015	10 136	39 551 N 123 595 W	1	2	1	1
40	3	30	13	1 11	851015	10 152	39 571 N 124 13 W	1	1	2	1
40	3		13	1 11	851015	10 155	39 577 N 124 18 W	1	1	2	1
40	11		13	1 11	851015	10 156	39 573 N 124 23 W	2			1
40	3	47	13	1 11	851015	10 200	39 574 N 124 23 W	1	2	1	1
40	4	39	13	1 11	851015	10 200	39 574 N 124 23 W	1	2	2	1
40	2	33	13	1 12	851015	10 258	40 44 N 124 80 W	1	2	1	1
40	5	44	13	1 12	851015	10 267	40 54 N 124 89 W	1	2	1	1
40	3		13	1 12	851015	10 268	40 54 N 124 89 W	2			1
40	1	30	13	1 12	851015	10 282	40 58 N 124 95 W	1	2	2	1
40	2	37	13	1 12	851015	10 288	40 64 N 124 104 W	1	2	1	1
40	2	45	13	1 12	851015	10 322	40 93 N 124 161 W	1	2	1	1
40	3		13	1 12	851015	10 339	40 96 N 124 169 W	2			1
40	5	27	13	1 12	851015	10 344	40 102 N 124 176 W	1	2	2	1
40	2	47	13	1 12	851015	10 344	40 103 N 124 176 W	1	1	1	1
40	23	29	13	1 12	851015	10 344	40 103 N 124 176 W	1	2	2	1
40	7		13	1 12	851015	10 367	40 107 N 124 171 W	2			1
40	3	63	13	1 12	851015	10 382	40 114 N 124 196 W	1	2	1	1
40	2	44	13	1 12	851015	10 388	40 121 N 124 206 W	1	1	1	1
40	2	31	13	1 12	851015	10 398	40 132 N 124 222 W	1	2	2	1
40	2	38	13	1 12	851015	10 400	40 134 N 124 223 W	1	2	1	1
40	2	54	13	1 12	851015	10 402	40 137 N 124 225 W	1	2	1	1
40	1	41	13	1 12	851015	10 409	40 145 N 124 235 W	1	2	1	1
40	1	34	13	1 14	851015	10 507	40 302 N 124 290 W	1	2	2	2
40	2	48	13	1 14	851015	10 511	40 305 N 124 286 W	1	2	1	2
40	1	58	13	1 14	851015	10 540	40 350 N 124 274 W	1	2	1	2
40	1	50	13	1 14	851015	10 545	40 357 N 124 269 W	1	2	1	2
40	2	61	13	1 15	851015	11 53	40 484 N 124 191 W	1	2	1	2
40	5	60	13	1 15	851015	11 54	40 488 N 124 188 W	1	2	1	2
40	11		13	1 15	851015	11 63	40 484 N 124 183 W	2			2
40	3	19	13	1 15	851015	11 95	40 497 N 124 178 W	1	1	3	2
40	4	55	13	1 15	851015	11 163	40 574 N 124 114 W	1	2	1	2
40	1	30	13	1 15	851015	11 202	41 21 N 124 110 W	1	2	2	2
40	1		13	1 15	851015	11 202	41 21 N 124 110 W	1	2	1	2
40	3		13	1 15	851015	11 222	41 33 N 124 115 W	2			2
40	3	43	13	1 18	851015	11 300	41 153 N 124 113 W	1	1	1	2

Table 10.

Marine Mammal Sightings
1985 Harbor Porpoise Aerial Surveys
Point Conception, CA, to the Oregon/Washington Border
September 11, 16-20, and October 14-15, 1985
Flights 1-10, 12-13

Marine Mammal Species Code	Estimated Number of Animals	Declination Angle to Sighting (Degrees)	Flight Transsect Leg	Sighting Number	Date	Local Time (Decimal) (Minute)	Position (Decimal Minute)	On=1 Off=2 Effort	Left=1 Right=2 Side	Inside=1 Outside=2 Extra=3 Swath	Beaufort Sea State
40	4	53	13 1 18	79 1	851015	11 358	41 240 N 124 81 W	1	2	1	2
40	3	43	13 1 19	80 1	851015	11 387	41 281 N 124 77 W	1	2	1	2
40	3	28	13 1 19	81 1	851015	11 399	41 303 N 124 79 W	1	2	2	2
40	2	39	13 1 19	82 1	851015	11 422	41 337 N 124 91 W	1	2	1	2
40	1	23	13 1 19	85 1	851015	11 453	41 382 N 124 101 W	1	1	2	2
40	1	51	13 1 19	86 1	851015	11 470	41 405 N 124 112 W	1	1	1	2
40	1	62	13 1 19	87 1	851015	11 475	41 412 N 124 116 W	1	2	1	2
40	1		13 1 22	93 1	851015	12 69	42 28 N 124 267 W	2		1	2
69	1	35	1 1 1	1 1	850911	11 17	41 553 N 124 126 W	1	2	2	3
69	1	55	4 2 10	11 1	850918	14 389	41 265 N 124 48 W	1	2	1	3
69	1	54	4 2 13	13 1	850918	14 515	41 439 N 124 103 W	1	2	1	3
69	1	14	13 1 14	67 1	851015	10 556	40 376 N 124 265 W	1	2	3	2
77	3		4 1 6	3 1	850918	12 426	39 27 N 123 418 W	1	1		2
80	1		2 1 17	17 1	850916	12 225	36 298 N 121 571 W	2			2
80	1	52	12 1 23	45 1	851014	12 402	36 180 N 121 553 W	1	2	1	1
91	1	35	1 2 5	2 1	850911	12 500	43 530 N 124 95 W	1	2	2	4
91	1	38	1 2 5	4 1	850911	13 2	44 90 N 124 72 W	1	1	1	4
91	1	52	2 1 11	1 1	850916	11 109	35 267 N 120 564 W	1	2	1	2
91	1	39	2 1 12	2 1	850916	11 240	35 391 N 121 136 W	1	2	1	2
91	3		2 1 12	4 1	850916	11 247	35 393 N 121 151 W	1	1	1	2
91	2	27	2 1 13	5 1	850916	11 277	35 399 N 121 169 W	1	2	2	2
91	1	32	2 1 13	6 1	850916	11 361	35 499 N 121 239 W	1	2	2	2
91	1	43	2 1 13	7 1	850916	11 412	35 523 N 121 272 W	1	2	2	2
91	5	27	2 1 13	8 1	850916	11 415	35 532 N 121 280 W	1	2	2	2
91	3	30	2 1 13	9 1	850916	11 422	35 542 N 121 282 W	1	1	1	2
91	1	34	2 1 14	10 1	850916	11 583	36 118 N 121 441 W	1	2	2	2
91	1		2 1 14	11 1	850916	11 585	36 121 N 121 445 W	1	1	1	1
91	2		2 1 14	12 1	850916	11 585	36 121 N 121 445 W	1	1	1	1
91	2	37	2 1 14	13 1	850916	11 587	36 122 N 121 448 W	1	2	1	1
91	5	43	2 1 14	14 1	850916	11 588	36 122 N 121 448 W	1	2	1	1
91	1	44	2 1 16	15 1	850916	12 148	36 214 N 121 551 W	1	2	1	2
91	1	41	2 1 17	16 1	850916	12 211	36 294 N 121 575 W	1	2	1	2
91	1	64	2 1 17	18 1	850916	12 238	36 298 N 121 574 W	1	2	1	2
91	1	53	2 1 17	19 1	850916	12 244	36 305 N 121 577 W	1	2	1	2
91	1		2 1 17	20 1	850916	12 261	36 323 N 121 565 W	1	1	1	2
91	2	52	2 1 17	21 1	850916	12 265	36 327 N 121 568 W	1	2	1	2

Marine Mammal Sightings
1985 Harbor Porpoise Aerial Surveys
Point Conception, CA, to the Oregon/Washington Border
September 11, 16-20, and October 14-15, 1985
Flights 1-10, 12-13

Marine Mammal Species Code	Estimated Number of Animals	Declination Angle to Sighting (Degrees)	Flight Transect Leg	Sighting Number	Date	Local Time (Decimal) (Minute)	Position (Decimal Minute)	On=1 Off=2 Effort	Left=1 Right=2 Side	Inside=1 Outside=2 Extra=3 Swath	Beaufort Sea State
91	1	44	2	1 20	850916	12 400	36 430 N 121 492 W	1	2	1	2
91	1	57	2	2 6	850916	14 586	37 133 N 122 252 W	1	2	1	2
91	1	34	2	2 8	850916	15 79	37 232 N 122 259 W	1	2	2	2
91	1	32	2	2 8	850916	15 141	37 311 N 122 316 W	1	2	2	2
91	1	54	2	2 10	850916	15 244	37 450 N 122 312 W	1	2	2	2
91	72	52	3	1 1	850917	11 119	38 176 N 123 41 W	1	2	1	2
91	6	37	3	1 4	850917	11 260	38 310 N 123 161 W	1	2	1	2
91	1	44	4	1 1	850918	12 155	38 325 N 123 182 W	1	2	1	2
91	1	27	4	1 4	850918	12 322	38 503 N 123 394 W	1	2	2	3
91	1	50	4	2 9	850918	14 223	41 67 N 124 106 W	1	1	2	3
91	1	33	5	1 5	850918	15 242	41 224 N 124 58 W	1	1	2	4
91	1	53	6	1 4	850919	10 182	40 276 N 124 272 W	1	2	1	3
91	1	36	7	7 1	850919	11 404	40 87 N 124 170 W	1	2	1	2
91	1	48	9	2 1	850919	14 108	41 8 N 124 191 W	1	2	1	4
91	5	32	10	1 16	850920	12 261	37 419 N 122 317 W	1	2	2	2
91	15	35	10	1 16	850920	12 261	37 419 N 122 317 W	1	1	2	2
91	2	36	10	1 16	850920	12 281	37 404 N 122 313 W	1	2	1	2
91	1	39	10	1 17	850920	12 302	37 401 N 122 311 W	1	2	1	2
91	4	35	10	1 17	850920	12 314	37 384 N 122 310 W	1	1	2	2
91	7	31	10	1 18	850920	12 332	37 374 N 122 310 W	1	2	2	2
91	1	54	10	1 24	850920	13 1	37 85 N 122 230 W	1	2	1	1
91	3	55	10	1 25	850920	13 16	37 63 N 122 216 W	1	1	1	1
91	2	40	10	1 40	850920	13 281	36 449 N 121 488 W	1	1	1	3
91	1	30	10	1 40	850920	13 303	36 417 N 121 492 W	1	1	2	3
91	1	48	10	1 45	850920	13 430	36 312 N 121 584 W	1	2	1	2
91	1	45	12	1 8	851014	11 198	34 570 N 120 402 W	1	1	1	2
91	7	25	12	1 9	851014	11 280	35 16 N 120 390 W	1	1	2	2
91	44	42	12	1 9	851014	11 280	35 100 N 120 430 W	1	2	2	2
91	1	42	12	1 11	851014	11 302	35 95 N 120 464 W	1	2	1	2
91	3	55	12	1 11	851014	11 340	35 133 N 120 531 W	1	2	1	2
91	6	50	12	1 11	851014	11 352	35 133 N 120 531 W	2	2	1	2
91	1	50	12	1 12	851014	11 438	35 263 N 120 545 W	1	1	1	2
91	27	65	12	1 12	851014	11 439	35 263 N 120 545 W	1	2	1	2
91	1	62	12	1 12	851014	11 445	35 263 N 120 558 W	1	2	1	2
91	1	52	12	1 13	851014	11 493	35 269 N 120 582 W	1	2	1	2
91	1	37	12	1 13	851014	11 494	35 304 N 121 44 W	1	2	1	2
91	1	50	12	1 13	851014	11 499	35 310 N 121 50 W	1	2	1	2
91	16	25	12	1 13	851014	11 510	35 310 N 121 60 W	1	1	3	2
91	15	35	12	1 13	851014	11 512	35 322 N 121 66 W	2	2	2	2
91	6	35	12	1 13	851014	11 540	35 328 N 121 67 W	1	1	2	2
91	1	35	12	1 14	851014	11 555	35 351 N 121 84 W	1	1	1	1
91	1	35	12	1 15	851014	12 37	35 460 N 121 224 W	1	1	1	1
91	1	33	12	1 18	851014	12 152	35 540 N 121 289 W	1	2	2	1
91	1	27	12	1 18	851014	12 152	35 540 N 121 289 W	1	1	1	1
91	1	27	12	1 19	851014	12 176	35 552 N 121 316 W	1	2	2	1

Table 10.

Marine Mammal Sightings
1985 Harbor Porpoise Aerial Surveys
Point Conception, CA, to the Oregon/Washington Border
September 11, 16-20, and October 14-15, 1985
Flights 1-10, 12-13

Marine Mammal Species Code	Estimated Number of Animals	Declination Angle to Sighting (Degrees)	Flight Transsect Leg	Sighting Number	Date	Local Time (Decimal) (Minute)	Position (Decimal Minute)	On=1 Off=2 Effort	Left=1 Right=2 Side	Inside=1 Outside=2 Extra=3 Swath	Beaufort Sea State
91	1	53	12	19	851014	12 192	35 575 N 121 326 W	1	2	1	1
91	1	45	12	20	851014	12 265	36 58 N 121 397 W	1	1	1	1
91	1	32	12	21	851014	12 325	36 119 N 121 453 W	1	2	2	1
91	5	30	12	21	851014	12 330	36 120 N 121 458 W	1	2	2	1
91	20	29	12	22	851014	12 352	36 133 N 121 475 W	1	2	2	1
91	2	66	12	22	851014	12 352	36 133 N 121 475 W	1	1	1	1
91	27	41	12	22	851014	12 355	36 137 N 121 479 W	1	2	1	1
91	28	69	12	22	851014	12 358	36 138 N 121 485 W	1	2	1	1
91	1	27	12	22	851014	12 361	36 142 N 121 488 W	1	2	2	1
91	1	50	12	22	851014	12 365	36 147 N 121 496 W	1	1	1	1
91	2	66	12	25	851014	12 474	36 245 N 121 572 W	1	1	1	1
91	2	36	12	26	851014	12 502	36 272 N 121 581 W	1	2	1	1
91	27	58	12	27	851014	12 542	36 322 N 121 587 W	1	2	1	2
91	1	54	12	27	851014	12 544	36 327 N 121 585 W	1	2	1	3
91	4	40	12	27	851014	12 544	36 327 N 121 585 W	1	1	1	3
91	1	41	12	27	851014	12 552	36 333 N 121 593 W	1	2	1	3
91	2	44	12	27	851014	12 556	36 341 N 122 7 W	1	2	1	3
91	1	30	12	27	851014	12 567	36 355 N 122 7 W	1	2	2	3
91	1	65	12	27	851014	12 569	36 357 N 122 5 W	1	1	1	3
91	1	37	12	27	851014	12 575	36 362 N 122 1 W	1	1	1	3
91	1	50	12	27	851014	12 593	36 377 N 121 589 W	1	2	1	3
91	3		12	28	851014	13 13	36 366 N 121 561 W	1	1	1	2
91	45	39	12	28	851014	13 17	36 361 N 121 555 W	1	2	1	2
91	7		12	28	851014	13 19	36 361 N 121 555 W	1	1	1	2
91	1	40	12	29	851014	13 40	36 362 N 121 534 W	1	1	1	2
91	3	43	12	29	851014	13 46	36 362 N 121 534 W	1	2	1	2
91	1	43	12	29	851014	13 71	36 374 N 121 532 W	1	2	1	2
91	1	38	12	5	851014	14 535	36 587 N 122 104 W	1	2	1	3
91	1	21	12	2	851014	15 9	37 62 N 122 196 W	1	2	3	3
91	3	48	12	2	851014	15 125	37 195 N 122 251 W	1	2	1	3
91	1	47	12	2	851014	15 250	37 359 N 122 320 W	1	1	1	3
91	1	50	12	2	851014	15 260	37 367 N 122 311 W	1	2	1	3
91	1	45	12	2	851014	15 276	37 391 N 122 307 W	1	1	1	2
91	1		12	2	851014	15 277	37 399 N 122 310 W	1	1	1	2
91	6		12	2	851014	15 279	37 399 N 122 310 W	2			2
91	3	40	13	1	851015	8 592	38 439 N 123 392 W	1	1	1	1
91	1	29	13	1	851015	9 20	38 455 N 123 419 W	1	2	2	1
91	1	37	13	1	851015	9 24	38 458 N 123 425 W	1	2	1	1
91	1	52	13	1	851015	9 24	38 458 N 123 425 W	1	2	1	1
91	1	41	13	1	851015	9 38	38 475 N 123 442 W	1	2	1	1
91	1	30	13	1	851015	9 42	38 479 N 123 450 W	1	1	1	1
91	1	39	13	1	851015	9 184	38 558 N 123 486 W	1	1	1	1
91	2	49	13	1	851015	9 383	39 140 N 123 506 W	1	1	1	1
91	2	50	13	1	851015	9 393	39 152 N 123 511 W	1	2	1	1

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Marine Mammal Species Code	Estimated Number of Animals	Declination Angle to Sighting (Degrees)	Flight Transsect Leg	Sighting Number	Date	Local Time (Decimal) (Minute)	Position (Decimal Minute)	On=1 Off=2 Effort	Left=1 Right=2 Side	Inside=1 Outside=2 Extra=3 Swath	Beaufort Sea State
91	1	31	13	1 15	851015	11 183	40 587 N 124 112 W	1	2	2	2
91	1		13	1 15	851015	11 222	41 33 N 124 116 W	2			2
91	1	35	13	1 19	851015	11 427	41 342 N 124 87 W	1	1	2	2
91	1	33	13	1 20	851015	11 502	41 464 N 124 141 W	1	2	2	2
91	1		13	1 21	851015	11 535	41 488 N 124 197 W	1	2	2	2
91	6	57	13	1 21	851015	11 535	41 488 N 124 197 W	1	1	1	2
91	17	33	13	1 21	851015	11 535	41 488 N 124 197 W	1	2	2	2
92	1	46	2	2 6	850916	14 542	37 83 N 122 213 W	1	2	1	2
92	1	64	12	2 14	851014	15 350	37 489 N 122 323 W	1	2	1	2
93	1	49	2	2 2	850916	14 317	36 574 N 121 548 W	1	2	1	2
93	24		2	2 12	850916	15 336	37 536 N 122 427 W	1	2	1	2
93	1	46	7	7 2	850919	11 414	40 85 N 124 192 W	1	2	1	3
93	1	54	12	1 12	851014	11 406	35 214 N 120 526 W	1	2	1	2
93	1	48	12	1 12	851014	11 430	35 254 N 120 537 W	1	2	1	2
93	1	56	12	1 16	851014	12 82	35 470 N 121 234 W	1	2	1	1
93	8	61	12	2 14	851014	15 309	37 426 N 122 313 W	1	2	1	2
95	1	40	1	2 5	850911	12 520	43 559 N 124 89 W	1	2	1	4
95	1		12	1 23	851014	12 415	36 180 N 121 553 W	2			1
97	1	46	1	2 5	850911	13 29	44 124 N 124 71 W	1	1	1	4
97	1	48	2	1 12	850916	11 247	35 392 N 121 144 W	1	2	1	2
97	1	40	2	2 7	850916	15 5	37 161 N 122 254 W	1	1	1	2
97	1	40	2	2 7	850916	15 13	37 170 N 122 253 W	1	2	1	2
97	1	42	2	2 1	850917	15 150	39 75 N 123 433 W	1	2	1	2
97	3	49	2	2 7	850918	14 102	40 517 N 124 113 W	1	1	1	4
97	1	40	4	2 12	850918	14 460	41 364 N 124 71 W	1	1	1	4
97	1	33	8	1 3	850919	12 102	40 247 N 124 278 W	1	2	2	4
97	1	41	12	1 4	851014	10 560	34 398 N 120 376 W	1	2	1	2
97	1	40	12	1 7	851014	11 105	34 555 N 120 406 W	1	1	1	3
97	1	54	12	1 9	851014	11 224	35 26 N 120 389 W	1	2	1	2
97	1	32	12	1 12	851014	11 366	35 158 N 120 540 W	1	1	1	2
97	1	31	12	1 19	851014	12 206	35 596 N 121 333 W	1	2	2	1
97	1	32	12	2 4	851014	14 487	36 564 N 122 31 W	1	2	2	3
97	1	63	12	2 25	851014	16 39	38 113 N 122 588 W	1	2	2	1
97	1	28	13	1 13	851015	10 425	40 169 N 124 252 W	1	2	2	2
97	1	49	13	1 14	851015	10 529	40 337 N 124 291 W	1	2	1	2
97	1	51	13	1 19	851015	11 429	41 348 N 124 90 W	1	2	1	2
97	1	47	13	1 22	851015	12 33	42 39 N 124 186 W	1	2	1	2

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Marine Mammal Species Code	Estimated Number of Animals	Declination Angle to Sighting (Degrees)	Flight Transect Leg	Sighting Number	Date	Local Time (Decimal) (Minute)	Position (Decimal Minute)	On=1 Off=2 Effort	Left=1 Right=2 Side	Inside=1 Outside=2 Extra=3 Swath	Beaufort Sea State
98	2	40	12 1 23	46 1	851014	12 402	36 180 N 121 553 W	1	1	1	1

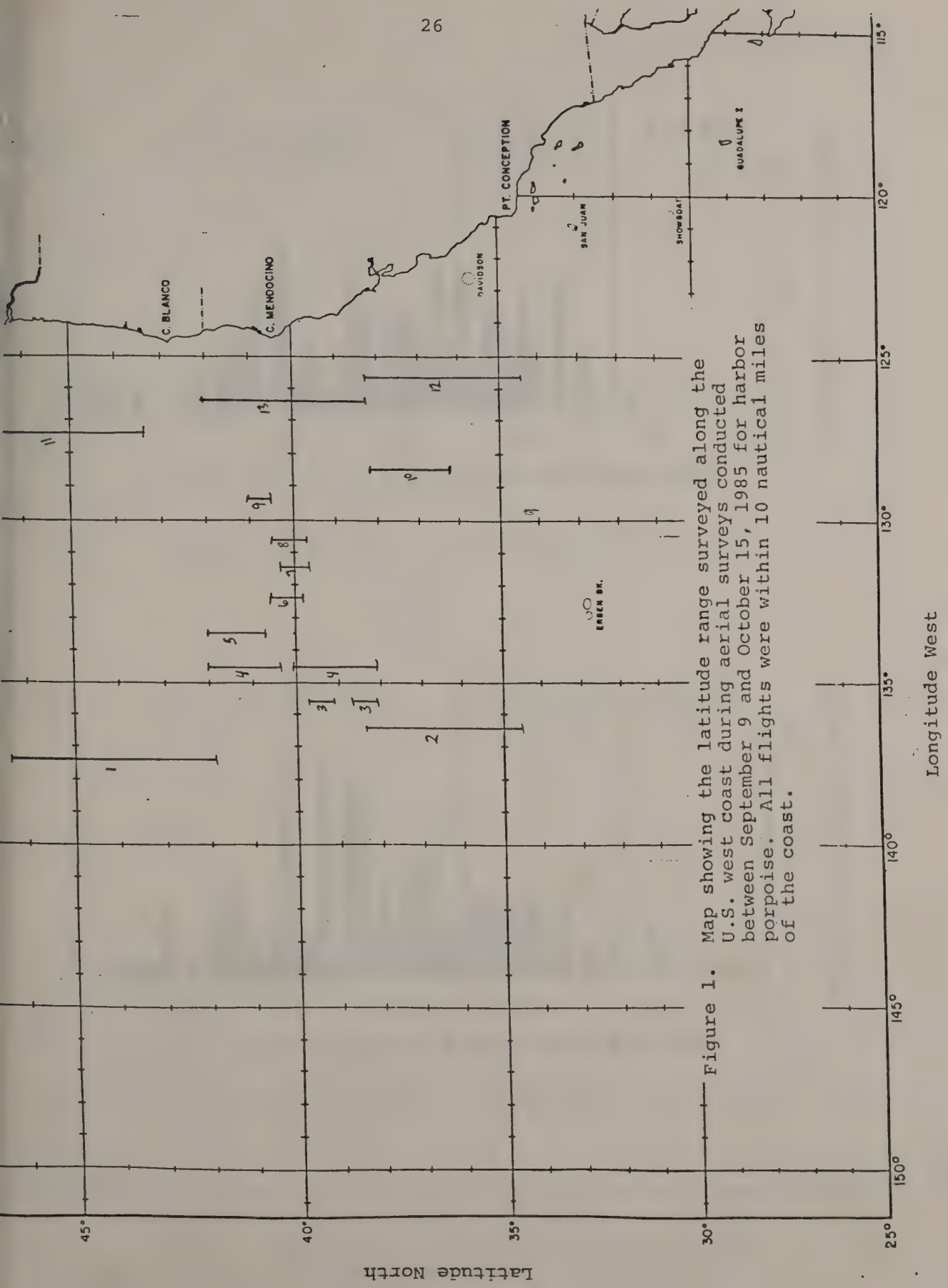


Figure 1. Map showing the latitude range surveyed along the U.S. west coast during aerial surveys conducted between September 9 and October 15, 1985 for harbor porpoise. All flights were within 10 nautical miles of the coast.

Longitude West

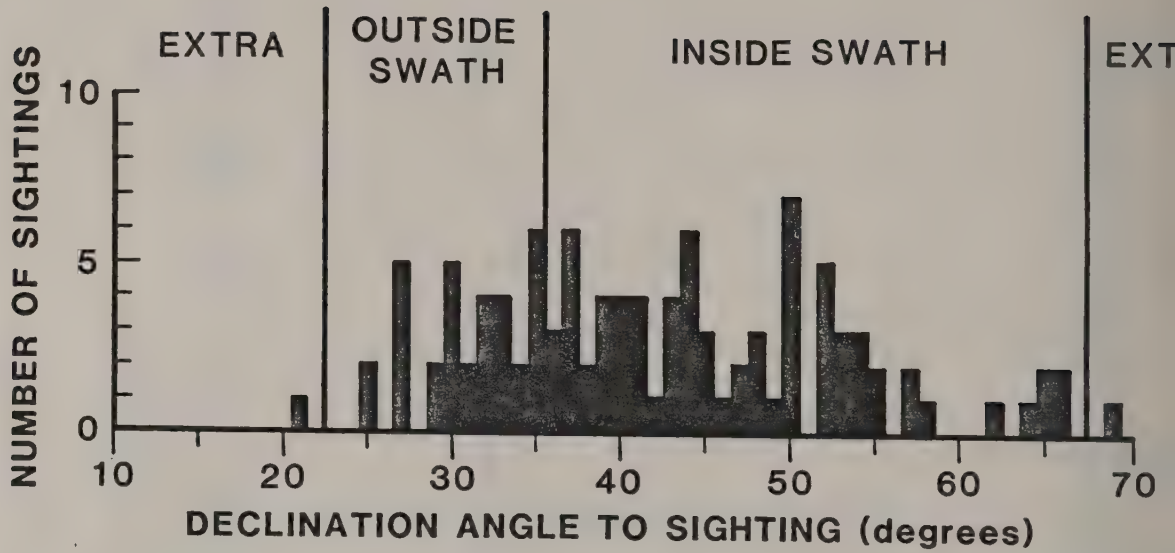


Figure 2. Frequency of sightings of California sea lions, by declination angle and swath, for flights 1-10 and 12-13 (N=107).

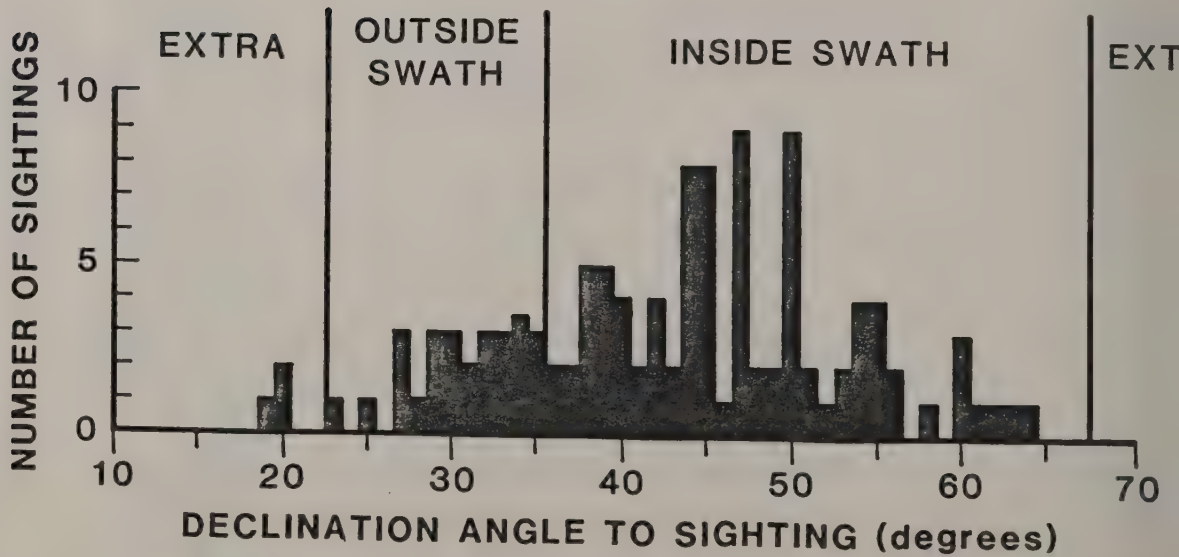


Figure 3. Frequency of sightings of harbor porpoise, by declination angle and swath, for flights 1-10 and 12-13 (N=118).

APPENDIX I. AERIAL SURVEY FORMS

DATE

FLIGHT NO.

AREA

 Transect No.
 Sighting No.
 Divert Times

Start or End Leg/Sighting

LAT

LONG

TIME

IN

OUT

LEFT VISIBILITY

EXTRA

IN

OUT

RIGHT VISIBILITY

EXTRA

Beaufort

Vert. Sun

Horiz. Sun

Altitude

 Declined is only
 to show this
 leg


DATE _____

FROM:

SWATH	WIDTH CODE
-------	------------

Declination
Angle To Shore
This leg

REASON FOR POSITION
1. Begin leg
2. Track check
3. Diver!
4. Overshoot
5. Return
6. End leg

[illegible]

